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DISCLOSURE OF AN INVENTION

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MAIN PATENT

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Absorbent article, and process for its manufacture

The present invention pertains to an absorbent article comprising absorbent fibers, especially cellulosic fibers, that are compressed into an envelope, whereby this article has a relatively high bending strength, a compressive strength that is also relatively high, and a high absorbing power.

Cellulose, either in the form of fibers, such as cotton fibers, or in the form of paper, such as pulped cellulose fibers or various other types of fibers or fibers that have been processed in order to increase their absorbing power, constitutes the best absorbent material. However, the materials that have been presented thus far, and absorbent cotton fibers or others, have limited use because of their lack of suitable strength, or because of the lack of means for keeping the packaging container clean or sterile for surgical purposes after it has been opened. In addition, the packets of absorbent fibers are generally voluminous, and this presents certain disadvantages; they are also prone to being contaminated and soiled. The fibers are very difficult to measure out, especially in small quantities, and, when the material has exerted its absorbent function, the object that results from this, which is composed of wet or soiled fibers, is difficult to reuse or handle.

These remarks are applicable to all the absorbent masses that have become known up to this point in time, whether they be formed from cotton fibers, from paper that has been pulped to a greater or lesser extent prior to being spreading out in sheet form during paper making, or other types of absorbent fibers.

It can be noted that the absorbing power of fibers generally depends on two distinct phenomena. One of these is the absorbing power of the individual fibers. Each cellulose fiber contains interstices or pores with very small dimensions into which the fluid, which is capable of being absorbed, is introduced and within which it is retained. The fibers also have a defined surface tension, and a high capillary force exists between adjacent fibers that tends to draw relatively large quantities of fluid into the spaces between the fibers. In the first of these two phenomena, the absorption of liquid into the body of the fiber is not, in essence, modified by its surroundings, but the capillary effect between adjacent fibers varies considerably depending on the proximity of the fibers to one another, and this part of the absorbing power of the cellulase fibers is increased considerably by moderate compression of the fibers that leads them to adopt an optimum separation distance.

If they are compressed too strongly, naturally, the fibers occupy too large a part of the total space, and effective absorption is reduced somewhat.

It has been found that the absorbent fibers can be converted into an absorbent article with a structure that is clearly different from known articles of this type. In this structure, the absorbing power of the fibers remains unchanged, but their physical properties are greatly improved such that the article offers maximum physical resistance to a crushing pressure.

The absorbent article in accordance with the present invention is characterized in that it comprises a body of absorbent fibers that are compressed and kept under compression in an open cylindrical envelope with extremities that consists of a material in the form of a flexible foil in such a way that this envelope is stretched out by the force of dilatation of the body of compressed fibers.

The invention also comprises a process for the manufacture of this article, characterized in that a core of absorbent fibers is formed in a machine, and in that this core of absorbent fibers is led to a compressor, and in that the absorbent fibers are compressed into a compact cylindrical body, and in that a flexible foil is wrapped around the cylindrical body, and in that the edges of the envelope are joined in such a way as to form a tube, and in that the cylindrical body is cut into individual lengths.

It will be noted that, in the majority of cases, the degree of pressure that is required for compressing the free fibers into a cylinder prior to envelopment is greater than the degree of pressure that is required for keeping the fibers compressed in the fixed envelope. In such cases, a greater pressure is necessary for enclosing the free fibers than for keeping these fibers "imprisoned". The reciprocal pressure immediately after "imprisonment" is perhaps 50 to 75% less, depending on the degree of compression and the moisture content. It is advantageous to exert an influence on the moisture factor in order to compress the fibers maximally, especially those of cotton, via a minimum of mechanical pressure. A favorable moisture content is contained within the limits of 6 to 16%.

Compression is preferably such that it produces a pressure on the envelope of approximately 0.07 kg/cm^2, or even less, with an upper limit of the order of 2.45 to 3.5 kg/cm^2 depending on the dimensions of the article, and on the particular fiber that is being compressed, and on the bursting strength of the envelope, and on the characteristics and type of envelope, etc.

A practical value for the pressure for the majority of the products that are used generally ranges between 0.14 and 1.4 kg/cm^2; it is preferable, however, that this pressure remains within values that are below this range. The highest pressures can be achieved for articles that are intended for industrial or special applications.

The tension on the envelope is preferably between 1/6 and 4/5 of the resistance thereof to traction (or approximately 16 to 80% of this resistance); higher values give a margin of safety that is too narrow, and values that are lower do not give sufficient structural strength. For example, a tissue envelope having a resistance to bursting of 0.25 kg/cm^2 could be subjected to a pressure of 300 g to 1.45 kg [per square centimeter] on the part of the fibers.

The absorbent fibers are preferably of cellulose, either in the form of cotton fibers, or in the form of wood fibers such as those that are used for the manufacture of paper. When use is made of paper fibers, it is of course desirable that treatment in a Jordan pulping machine be relatively mild in order to reduce the quantity of hydrated cellulose that is produced, since hydrated cellulose tends to decrease the absorbent properties of the fibers.

It will be evident that the fibers that are used should be absorbent and sufficiently elastic in order to be compressible and, after compression, they should give rise to the required tension on the envelope.

The envelope can be of paper in whatever form depending on the fiber, which has to be compressed in the interior of this envelope, and on the use for which the article is intended. In the majority of cases, it is desirable to have a thin, strong paper that is nevertheless resistant to water, but it is not necessary that this paper be absorbent since the open extremities of the packaging provide access to the liquid that is to be absorbed. For a limited number of applications, a tissue can be used for forming the envelope, but this is less satisfactory because of the difficulty of rendering the tissue impermeable and in rapidly joining the edges by stitching, whereby such stitching has to have adequate resistance to traction.

It is not necessary that the fibers be parallel for the manufacture of the article, but a proportion of the fibers, of the order of 90% to 2 or 3%, can be placed parallel to the axis of the cylinder, hence allowing the remainder to be distributed in any direction. It is, likewise, unnecessary that the core be twisted prior to compression or that such twisting be avoided. For the majority of applications, slight twisting amounting to one or two turns per inch or to one turn over a length of several inches is advantageous in the compression operation.

The criterion for the degree of compression of the fibers in the interior of the envelope is that, if the fiber is free, it dilates, naturally or possibly aided by slight manipulation of the fingers, from at least 1/4 or ½ of its volume up to 35 times its compressed volume, whereby the minimum degree of compression slightly exceeds that which is necessary for preventing the fiber from leaving the envelope, and whereby the maximum degree of compression is limited by the tensile strength of the envelope. Another criterion for the value of the degree of compression is the impossibility, via simple manipulation with the fingers, of putting the fiber, in intact form, back into the envelope again.

The article in accordance with the invention preferably has a minimum diameter of approximately 6.3 mm or 4.8 mm, and a maximum diameter of approximately 2.54 to 3.8 cm; for the majority of cases, the length that is suitable ranges from 1.6 mm to 15 or 18 cm, whereby these magnitudes again depend on the diameter and on the use for which the article is intended. For a cylinder with a diameter of approximately 6.3 mm and a length of 2.54 cm, which is formed from absorbent fibers in a stretched out envelope, the following values can be indicated for its structural strength: it should have a resistance to transverse bursting between 453 g and 22.8 kg and a resistance to longitudinal bursting between these same values, whereby the values in the lower part of this range are preferred in the majority of cases. Such an article exhibits an absorption for liquids that can be increased to ½, or to 3/5 or to 4/5 of its own volumetric capacity without harming its physical strength and without its undergoing an appreciable change in shape or dimensions (especially when an impermeable envelope is used).

By way of example, the appended drawings represent various forms of embodiment of the article in accordance with the invention, and illustrate the implementation of the process for the manufacture of this article.

Fig. 1 is a perspective view of an article.

Fig. 2 is a transverse sectional view of Fig. 1.

Fig. 3 is a perspective view of the article that contains a tear-off strip.

Fig. 4 is a perspective view of the article that has a perforated envelope.

Fig. 5 is a perspective view of the article of Fig. 4 that shows how it can be opened via pressure from the thumbs.

Fig. 6 is a view of the envelope and the compressed cotton, separated for use.

Fig. 7 is a perspective view of a form of embodiment in which one part of the envelope is reinforced by an additional enveloping element in order to form a sleeve.

Fig. 8 is a perspective view of the article of Fig. 7 opened in order to produce a powder puff that is intended to be used on one single occasion.

Fig. 9 is a perspective view of a form of embodiment in which an impermeable envelope is perforated at its periphery and transversely relative to one extremity.

Fig. 10 is a perspective view of the article of Fig. 9 that has been opened in order to produce a medical tampon that is intended to be used on one single occasion.

Fig. 11 is a perspective view of a form of embodiment of the article comprising an impermeable envelope, whereby the capillary absorbing power is controlled by additional pressure that is exerted toward the extremity of the article with the help of a cord that can be tightened.

Fig. 12 is a perspective view of a variant that represents articles of short length in which the diameter is greater than the length, whereby these articles are particularly suitable for surgical purposes, in dentology [sic; dentistry], and for absorbent laboratory disks.

Fig. 13 is a perspective view of a dental roll that has an impermeable envelope that is intended to furnish maximum resistance to deformation at the moment of saturation, and thus continue its mechanical blockage

and stoppage of liquid at the protected surface, whereby absorption is produced by the extremities of the article.

Fig. 14 is a perspective view of another form of embodiment of the article in which both the degree of absorption and dispersion are controlled by the presence of an atomized coating of an impermeable material on the envelope and the cut extremities.

Fig. 15 is perspective view of a packaging arrangement, which contains several articles in conformity with the invention, that shows the compactness, the economy, and the convenience of the packaging arrangement for the absorbent article.

Fig. 16 is a perspective view of a distributor that shows an easy and appropriate way for distributing several articles, which are in conformity with the invention, to the user.

Fig. 17 is a perspective view of a form of embodiment in which use is made of corrugated or striated cotton for the absorbent material.

Fig. 18 is a view of the envelope and of the corrugated cotton, separated for use.

Fig. 19 is a schematic view of an installation for the manufacture of the article in accordance with the invention.

The article represented in Figs. 1 and 2 comprises an envelope 1 having a mass or body of compressed fibers 2 in its interior. As has already been indicated above, the envelope 1 preferably consists of paper of good quality, with a thickness and texture that depend on the characteristics of the fiber, which is contained therein, and on the degree of compression of this fiber. The paper envelope 1 is for more or less impermeable applications, though impermeability is neither necessary nor essential. The paper can range from the thinner Japanese paper if the fibers have a low level of overcrowding and are subjected to slight compression, to stronger paper if the fibers are large and strongly compressed. In a variant, use can be made of regenerated cellulose in the form of foil; use can also be made of any quality of paper that can be "mercerized" to a greater or lesser extent with a diluted metallic hydroxide in order to increase its permeability and its strength, or that can be rendered completely impermeable as a result of treatment with wax, either paraffin wax or natural waxes or a mixture thereof. For certain applications, slight impregnation with non-vulcanized rubber latex, either synthetic or natural, is suitable; for other applications, slight impregnation with natural or synthetic rubber or a resin such as poly(vinyl alcohol) is useful.

The fibers that are contained therein are preferably of cotton, namely of any quality of cotton that is available and capable of being used for this purpose. The preferred quality consists of very short fibers, which have been washed and bleached, from spinning mill waste. Wads of cotton can be used provided that they are approximately the same quality as the spinning mill wastes. On occasions, it can be desirable for limited and special applications to have fibers of cotton that are longer, but any quality that is suitable and any length of fibers can be used, whereby the determinant factors are, first of all, cost and availability. An animal fiber can be useful for certain special cases. Wool is particularly useful where oils of all types have to be absorbed. In a similar manner, regenerated cellulose fibers in the form of rayon fibers can be used on occasions. Use can also be made of nylon fibers for a small number of applications that are strictly limited, and even fibers comprising asbestos or spun glass.

In order to prepare the article, the fibers are first compressed to the desired value and in the required manner, and the envelope is then applied. The fibers are prepared and compressed in the form of a long strip or cord, and the envelope is cut up in an analogous manner in the form of a long strip starting from a roll, for example. The compressed fibers are then enveloped in the enveloping material, and the edges of the envelope are closed over the compressed fibers and sealed together. This can be achieved with the help of a paste, or mastic, or wax if use is made of paper, especially a wax of high strength, whereby sufficient closure can be obtained for the envelope by simply superimposing the edges of the envelope and applying heat. In the case in which rubber materials or various resins are incorporated into the enveloping material, the appropriate adhesive material can be used in the same way for closing the seam of the envelope.

The seam of the envelope can also be closed by a "corrugation" or "milling" operation or, if desired, by a punching or lacing operation, or by rolling the enveloping material in the form of a continuous spiral with the seams of the cover being processed in the same way as mentioned above.

In certain cases, a tear-off strip can be incorporated into the article as represented in Fig. 3. In this form of embodiment, the envelope 1 keeps the fibers 2 under compression, whereby this envelope is joined as indicated above and equipped with a tear-off strip 3. This strip can have the shape of a filament that is incorporated, together with the fibers, during the application of the envelope, or it can have the shape of a strip of paper that is especially strong, or of a strip of regenerated cellulose, or an analogous material. If desired, the tear-off strip can be partially freed from the envelope by means of small cut-through indentations on each side, as represented in Fig. 3, or they can be doubled in certain locations in order to furnish a double prolongation, or the extremities can be knotted when they are cut. During the use of this form of embodiment, the tear-off strip can be drawn downward over a small distance that frees part of the fibers at one extremity. The tuft that is formed in this way surmounts a grip and can be used, for example for sponging or applying a cosmetic or medications, or small portions of fibers can be pulled outward and used for other applications, whereby the tear-off strip is pulled downward little by little to an extent that depends on the fibers that are used.

In one variant, the envelope can be weakened along a desired line by means of a series of perforations, either by means of slots or by means of perforated holes as represented in Fig. 4. In this form of embodiment, the envelope 1 is equipped with compressed fibers 2 for its filling that furnish a tension at the envelope 1, and also a line of perforations 4 along the article. The perforations must be considerable in number, but they do not have to extend to the point of weakening the envelope in such a way that it breaks under the influence of the tension of the fibers that it contains.

The use of this form of embodiment is represented in Fig. 5. in which the thumbs of the operator are applied to the envelope 1 in opposition to the pressure of the filling fibers 2 on each side of the line of perforations 4 in such a way as to cleave this envelope along the said line, whereby this cleavage continues from one extremity to the other as far as is desired. As a result of this operation, a certain quantity of fibers, in the free state, can be furnished at the center, or the envelope can be completely removed, whereby this frees a package of fibers of cotton that can be used for any desired application. Fig. 6 represents the slackened cotton that is ready for use. This article is particularly suitable for surgical use, in which loose fibers are desired, whereby the relatively high density of compressed fibers gives an article that is easy to store, and the remainder of the envelope furnishes a tampon of high quality that is ready for use. In order to guarantee a property that is above average even in applications of very little importance with usage on one single occasion, this tampon can easily be furnished under conditions that are completely sterile to surgeons or to practitioners of first aid simply by rendering the article impermeable by atomizing wax or resin onto the entire surface of this article, and by sterilizing the said finished article. Although such a layer seals the perforations, it does not impede their functioning. Small cotton tampons are thus achieved that can be guaranteed to be sterile up to the moment of opening the packaging.

In addition to the character of sterility in this form of embodiment, an appropriate line of adhesive can be traced horizontally on the interior of the envelope in order to keep this envelope on the tampon after opening. In the case of non-impermeable paper, the atomized layer penetrates into the pores of the material that forms the envelope and maintains the envelope, when opened, against the slackened fibers. A strip of paper can also be rolled parallel to the envelope between the compressed fibers and the interior of the wall of the envelope as in the case of the tear-off strip that was described above. The slack strip is situated just below the perforations of the envelope, and the adhesive is situated just half way around the periphery starting at the said perforations. This paper, which is provided above the cotton tampon, and the free paper at the tip of the cotton tampon help the surgeon or the practitioner to open and spread out the single use application without the fingers contacting the fibers themselves. This constitutes a very important element in surgery where the materials that are used or applied have to be absolutely sterile.

Another form of embodiment uses part of the length of the article as a sleeve, as represented in Figs. 7 and 8. In this form of embodiment, as in the other examples, the envelope 1 is equipped with a filling of compressed fibers 2 that give the desired tension to the envelope. Reinforcement 5 is provided at one extremity of the article and has the shape of another piece of rolled paper. This reinforcement is easily applied by processes that are well known. The envelope 1 is applied in the same way as previously and, if desired, it can be equipped with perforations 4 as in the example of Figs. 4 and 5, or with a tear-off strip

as in the example of Fig. 3. This article is also compact and easy to store and to ship.

In use, the non-reinforced extremity can be opened at the perforations, if they are present, in the same way as represented in Fig. 5, namely with the help of a tear-off strip in order to furnish a tampon for powdering for use on one single occasion, or analogous usage as represented in Fig. 8, in which the envelope 1 is reinforced over part of its length by the auxiliary strip 5 but has a longitudinal slot on another part of its length, whereby this part of the envelope can be torn against the edge of the reinforcement 5 and hence liberates the fibers 2 at one extremity in the form of an enlarged ball that can be ruffled up via simple manipulation with the fingers. This article is particularly suitable for a tampon for powdering, with use on one single occasion, that can be carried with ease in a lady's handbag and, if desired, it can be provided with any color that is desired, and with a perfume, and with powder during its manufacture, while thereby avoiding a separate reserve of powder, along with a small separate tuft for repeated use.

A simpler variant, though with the features of this form of embodiment, that is intended for special usage is represented in Fig. 9. The body of the "baton" is equipped here with a grip, though without reinforcement. The envelope 1 is made of a material corresponding to one of the impermeable types described previously and holds the fibers 2. In this form of embodiment, the perforations 4*A* are effected at one extremity around the periphery, and transversely relative to this extremity. In use, the envelope is torn, via the fingers, at the perforations at the periphery and horizontally, but evidently not toward the bottom at the place where the reinforcement grip is located as represented in Fig. 8.
The extremity, which is released and somewhat dilated, is then rumpled up via simple manipulation with the fingers as in the case of a small tuft. However, this form of embodiment is more particularly appropriate for an inexpensive, efficient, medical tampon for use on one single occasion. The peripheral perforations 6 are effected by needles or knife blades, which are controlled by projecting cams, starting from the tip, from the bottom, and from the sides of the finished stretched out tube, which is maintained in the correct position, or perforations can be made in the paper before rolling up. Fig. 10 represents a medical tampon that is ready for use.

For certain purposes, normal compression of the fibers in the packaging containers furnishes a higher absorbing power than is desired and, in some cases, it is preferable to restrict the absorbing power to a small part of the article. This is achieved with ease by the form of embodiment of Fig. 11 in which the envelope 1 is equipped, as previously, with absorbent fibers 2 as in the form of embodiment in Figs. 1 and 2. A cord 7 is then tightened at a distance that is more or less close to one of the extremities of the "baton". This ligature can be tightened quite strongly, and therefore produces a marked reduction in the absorbing power of the fibers both directly as a result of the effect of this tightening as well as by restricting the distance covered by the liquid that is absorbed in the main body of the article. Compared to that of Figs. 9 and 10, this form of embodiment of the device is particularly useful for applying ointments, medicinal oils and, especially, substances that are fluid or semi-fluid because it gives the advantage of the absorbing power of the fibers while preventing wear of the material in the body of the article, whereby this thereby permits reuse for medicinal and analogous purposes.

For some applications, it is very desirable to have a tampon that is very small with absorbent fibers firmly retained in a receptacle.

The form of embodiment in Fig. 12 represents this form of structure particularly well. In this case, the envelope also furnishes a cover for the fibers 2 as shown. This form of embodiment is exactly the same as that in Fig. 1, but the ratios of the length relative to the diameter are modified in such a way that a maximum surface area (or extremities of the fibers) shall be available for rapid absorption with a minimum of stretched out wrapping materials. In this case, the length can be 3.2 mm or a little less than 9.5 to 12.5 mm, and the diameter can be 4.7 mm or less than 19 mm. This form of article can be arranged freely in a packaging container in such a way that it can be extracted by the user by means of tweezers, and then used as desired and then destroyed, whereby this article is again for use on one single occasion.

The article that has been described is particularly useful for dental treatments with the objective of keeping the teeth and parts of the mouth dry during the operation that is being carried out by the dentist. In the case of this objective, it is preferable, though not necessary, that the envelope 1 be impermeable or, better, rendered impermeable by a coating of resin 8 as represented in Fig. 13. Some wax or some non-vulcanized rubber latex can be used, but this is less agreeable in the mouth of the patient and use is preferably made of an envelope that contains a light filling comprising polystyrene or poly(vinyl alcohol)

or another appropriate resin. The strength of this article is increased by the envelope's being rendered impermeable, and the duration of its being in the mouth of the patient is also increased particularly when it approaches the saturation point. At the same time, the absorption of saliva through the extremities of the baton (as a result of the use of fibers of wood cellulose with more rapid absorption than conventional cotton fibers) is sufficient in order to keep the field of operation dry and the article does not become a water-soaked mass in the mouth of the patient, and it does not become incapable of continuing its main function of mechanically blocking the tongue and the cheeks and favoring, rather than preventing, the arrival of the liquid in the field of the operation.

This property permits the use of a single roll for a much extended part of the dental operation than is usually the case with known rolls since the absorbing power is large and the structure does not lose its strength nor drain out when it is removed as is inevitably the case with the ordinary type of dental roll.

It is desirable that the envelopment be entirely impermeable in a dental roll and that the free extremities exert the maximum absorption. In certain cases, however, it is desirable that absorption take place through the sides of the baton. In the case of this objective, the form of embodiment in Fig. 14 furnishes a finished article that is covered via atomization, or by coating the covering material before envelopment, with droplets of an impermeable material such as paraffin, a non-vulcanized rubber latex or a resin with a certain viscosity and dimensions that are sufficiently small that they do not extinguish the absorbent interstices between the adjacent droplets but leave [them in existence] in order to permit limited penetration of the absorbable liquid. The dental rolls can thus be equipped with cotton fibers, rather than wood cellulose fibers, and with a packaging material comprising crepe paper or perforated paper or absorbent porous paper of high wet strength.

The preceding forms of embodiment have shown slackened fibers that were used as the compressed element in the interior of the envelope, whereby cotton is particularly useful in these various cases. Fibers of cellulose of whatever type are also satisfactory, however. Use can also be made of fibers comprising alkaline wood pulp that is prepared in the raw state directly from pulp from the spinning mill (pulp mill). These fibers have an absorbing power that is greater than that of cotton fibers, especially if the treatment in a Jordan pulping machine has been light, and such paper fibers can be used in all the forms of embodiment of the invention that are described.

If desired, the absorbent filters can be treated in different ways. They can be slightly twisted into filaments that can be spread out in parallel, or they can be slightly twisted and then compressed and enveloped as described previously, or these fibers can be reduced to fragments and then compressed and enveloped.

Cotton can also be "corrugated", whereby the corrugated body is rolled, folded or gathered together and then compressed and packaged in an envelope as described previously. The envelope 1 as represented in Figs. 17 and 18 can be perforated as represented in Fig. 5. When it is opened, the article furnishes a spread out foil of compact cotton fibers 2 that is especially adapted for wiping such as a wiping cloth for use on one single occasion, or as a tampon for powdering using powder (or with powder in the corrugated leaves comprising cotton fibers), or for other uses both surgical and cosmetic.

An important advantage of the article that has been described is its compactness. Approximately 30 g of slack absorbent cotton occupy a space of approximately 6 cm in diameter and 12 to 15 cm in length from which it is found that, in addition to the cost of the packaging, it is voluminous and expensive to ship, expensive to store, and bulky and impractical in use. In the article that has been described, the same quantity of cotton occupies approximately 1/5 of its gross volume and, as represented in Fig. 15, approximately 30 g of compressed cotton in 60 separate pieces (3 layers of 20) can be shipped in a 40 to 80% smaller space than for cotton in all its usual forms.

In Fig. 15, several "batons" comprising a stretched out envelope 1 and compressed fibers 2 can be packaged in a box 12 that is relatively small and suitable for shipping or distribution. Many other forms of packaging for distribution could be imagined by someone who is skilled in the art. The fact that the fibers have already been subdivided into small portions, which are kept clean or sterilized in individual envelopes, considerably increases their safety in use, and reduces the wastage of fibers that would otherwise appear inevitable.

Fig. 19 illustrates an example of using a process in which fibers are prepared, initially in a machine 21 for forming a continuous core, and then passed through an apparatus 22 such as an apparatus for plaiting or corrugating if desired, and for final treatment of the cotton in any desired way. These machines operate relatively slowly, and they furnish the product in the form of a core at a speed that is much less than that of the enveloping machine. In order to ensure that sufficient material is furnished to the enveloping machine in a discontinuous and continuous manner, the product is stored, in the form of a core, in a receptacle 23 if the product is not elongated or connected to other products. Several machines for forming a core can be operated simultaneously or over a longer period of time than the enveloping machine, whereby each furnishes its product to a receptacle. The product, in the form of a core or card, is then led, from successive receptacles, through a device 24 with a roller for joining, folding or wrapping, and then to a primary compressor 25. These devices can both utilize compression rollers and, in order to facilitate compression, use can also be made of controlled humidity and heat. The fibers from the principal compressor device are led to the envelopment machine. This envelopment machine can consist of a tunnel into which the fibers are introduced in the compressed state and in the form of a strip along an envelopment strip 1 that has already been rendered impermeable and perforated at 35 if desired. This device can be a simple tunnel, or it can be a combination of a tunnel and auxiliary compression rollers that can also comprise packaging rollers, gluing rollers, rollers for corrugating the envelope or for plaiting, sealing and analogous operations depending on the characteristics of the particular fibers that are to be used, and on the characteristics of the envelopment material as well as on the use for which the finished article is intended. The tear-off strip 3 can also be included at 26 at this time. Starting out from the principal compression device, the baton of compressed fibers and the stretched out envelope can be led to a device for applying the auxiliary reinforcement envelope, if there is one, as indicated at 27; or this reinforcing envelope can be applied later by means of a supplementary operation. Auxiliary impression, compression and formation devices can be provided, such as a perforator 28, and appropriate means 29 for attachment can also be placed at this point, or applied later by means of a supplementary operation.

The last unit in the machine is a knife 33 that is intended for cutting the "baton" into appropriate individual lengths and, if it is not yet perforated, a perforating device is provided for cutting and perforating simultaneously. These individual lengths can then be stacked on trays and taken to an appropriate packaging machine.

The machine that has been described permits the manufacture of an article that is formed by a body or "baton" of compressed fibers that are enclosed in a stretched out envelope, whereby this article has very great physical strength and considerable absorbing power combined with a noteworthy reduction in volume of the fibers that are packaged in this way, along with the multiple modifications, advantages, economy, and usage that are indicated above.

CLAIMS

I. Absorbent article, characterized in that it comprises a body of compressed absorbent fibers that are kept under compression in an open cylindrical envelope, with extremities, consisting of a material in the form of a flexible foil in such a way that this envelope is stretched out by the force of dilatation of the body of compressed fibers.

II. Process for the manufacture of the article in accordance with Claim I, characterized in that a core of absorbent fibers is formed in a machine, and in that this core of absorbent fibers is led to a compressor, and in that the absorbent fibers are compressed to give a compact cylindrical body, and in that a flexible foil is wrapped around the cylindrical body, and in that the edges of the envelope are joined in such a way as to form a tube, and in that the cylindrical body is cut into individual lengths.

SUB-CLAIMS

1. Article in accordance with Claim I, characterized in that the absorbent fibers are of cellulose.

2. Article in accordance with Claim I and sub-claim 1, characterized in that the material of the envelope is paper.

3. Article in accordance with Claim I, characterized in that the material of the envelope has been rendered at least partially impermeable.

4. Article in accordance with Claim I, characterized in that the pressure exerted by the compressed fibers on the envelope, which surrounds them, is 0.14 to 1.4 kg/cm^2.

5. Article in accordance with Claim I, characterized in that the tension that is applied to the envelope by the compressed fibers is equal to 16 to 80% of the resistance to traction of the material that constitutes this envelope.

6. Article in accordance with Claim I, characterized in that the body of fibers is compressed to a value such that, when they are liberated from the envelope, they dilate naturally from at least one quarter of their compressed volume to 35 times their compressed volume.

7. Article in accordance with Claim I, characterized in that the envelope is perforated in order to facilitate its removal at least partially.

8. Article in accordance with Claim I, characterized in that it comprises a tear-off strip in order to effect removal, at least partially, from the envelope.

9. Article in accordance with Claim I, characterized in that it comprises a tear-off filament in order to effect removal, at least partially, from the envelope.

10. Article in accordance with Claim I, characterized in that the envelope comprises a part that is formed from a single thickness of material in the form of a foil, and a portion comprising at least one supplementary thickness of material in the form of a foil.

11. Article in accordance with Claim I, characterized in that the envelope is coated with a discontinuous layer of an impermeable material in such a way as to allow the interstices to continue to exist, whereby this permits limited absorption through the envelope itself.

12. Article in accordance with Claim I, characterized in that it comprises a mass of hydrophilic cotton in a tube made from paper tissue, whereby this mass is compressed to a value such that the paper is subjected to a tension that is equal to 16 to 80% of its resistance to traction.

13. Article in accordance with Claim I and sub-claim 12, characterized in that the tube is perforated longitudinally in order to facilitate its removal.

14. Article in accordance with Claim I and sub-claim 12, characterized in that the hydrophilic cotton is in the form of a compressed core.

15. Process in accordance with Claim II, characterized in that the absorbent fibers are moistened prior to compression.

16. Process in accordance with Claim II and sub-claim 15, characterized in that the moisture content of the fibers is taken to a value between 6 and 16% of the weight of the fibers.

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Patent No. **293301**
2 sheets. No. 1

Millard Seymour Banks

Patent No. **293301**
2 sheets. No. 2

Millard Seymour Banks

Brevet N: 293301
2 feuilles. N° 1

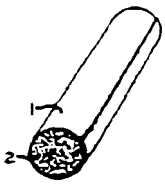

Fig. 1

Fig. 2

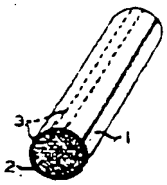

Fig. 3

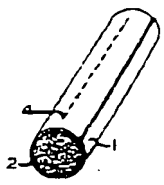

Fig. 4

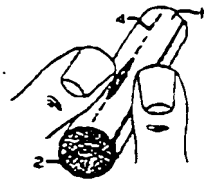

Fig. 5

Fig. 6

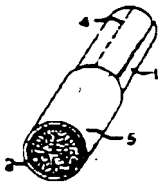

Fig. 7

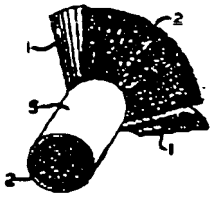

Fig. 8

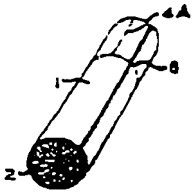

Fig. 9

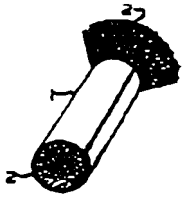

Fig. 10

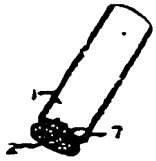

Fig. 11

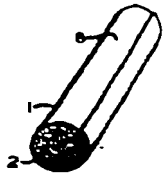

Fig. 13

Fig. 14

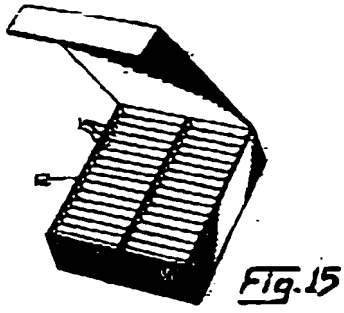

Fig. 15

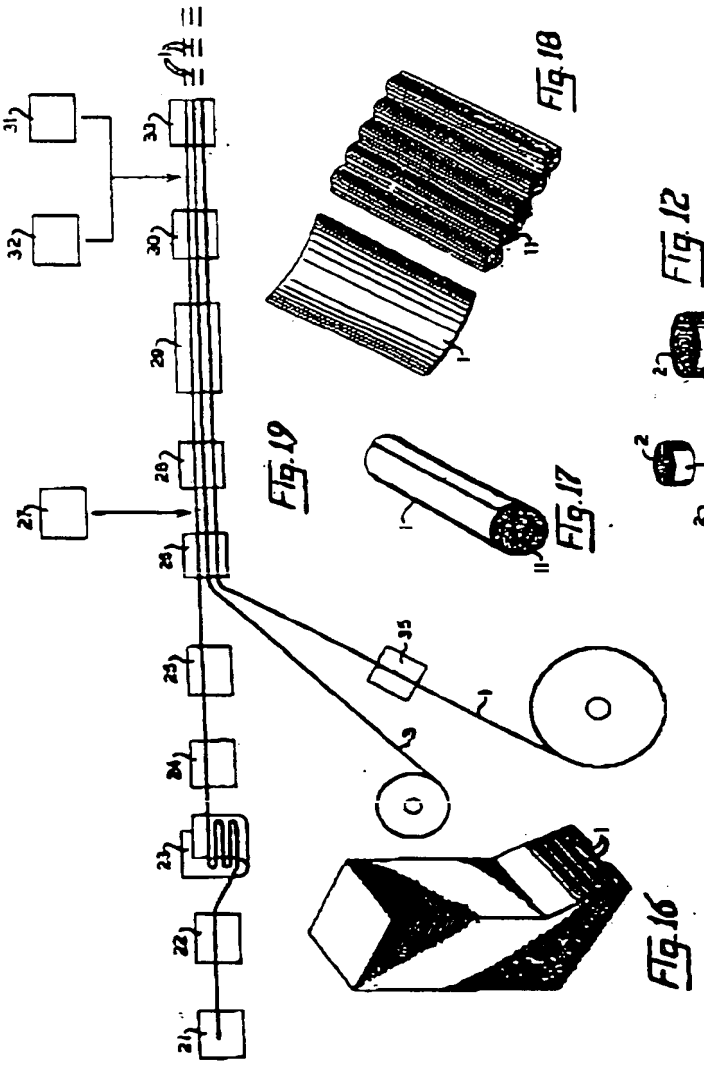

Fig. 19

Fig. 18

Fig. 17

Fig. 12

Fig. 16